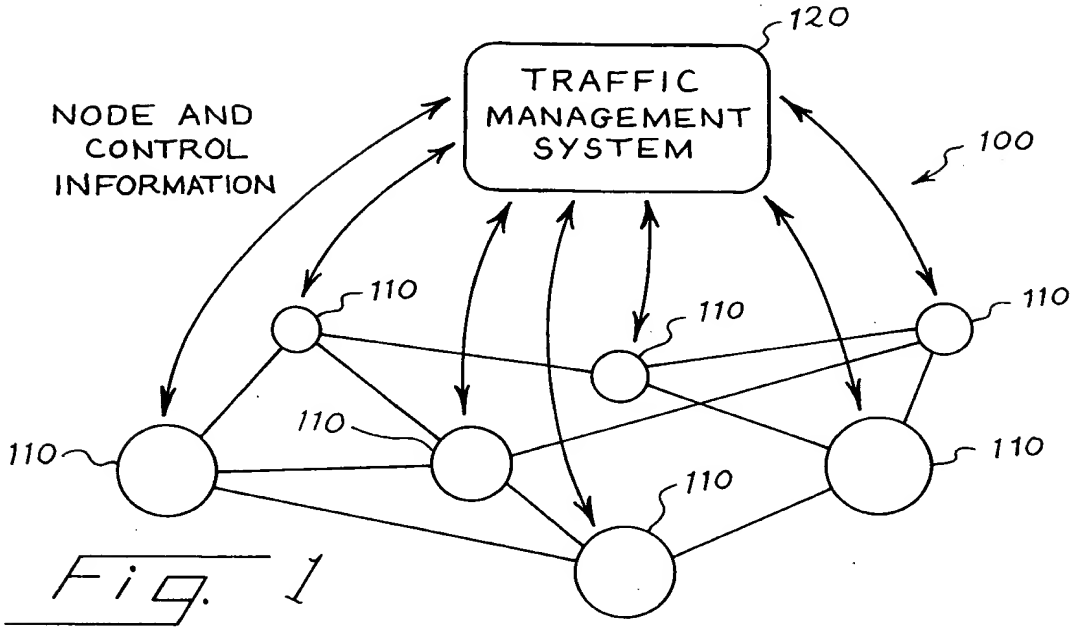

TRAFFIC MANAGEMENT SYSTEM
120
100
NODE AND CONTROL INFORMATION
110
110
110
110
110
110

Fig. 1

Fig. 2

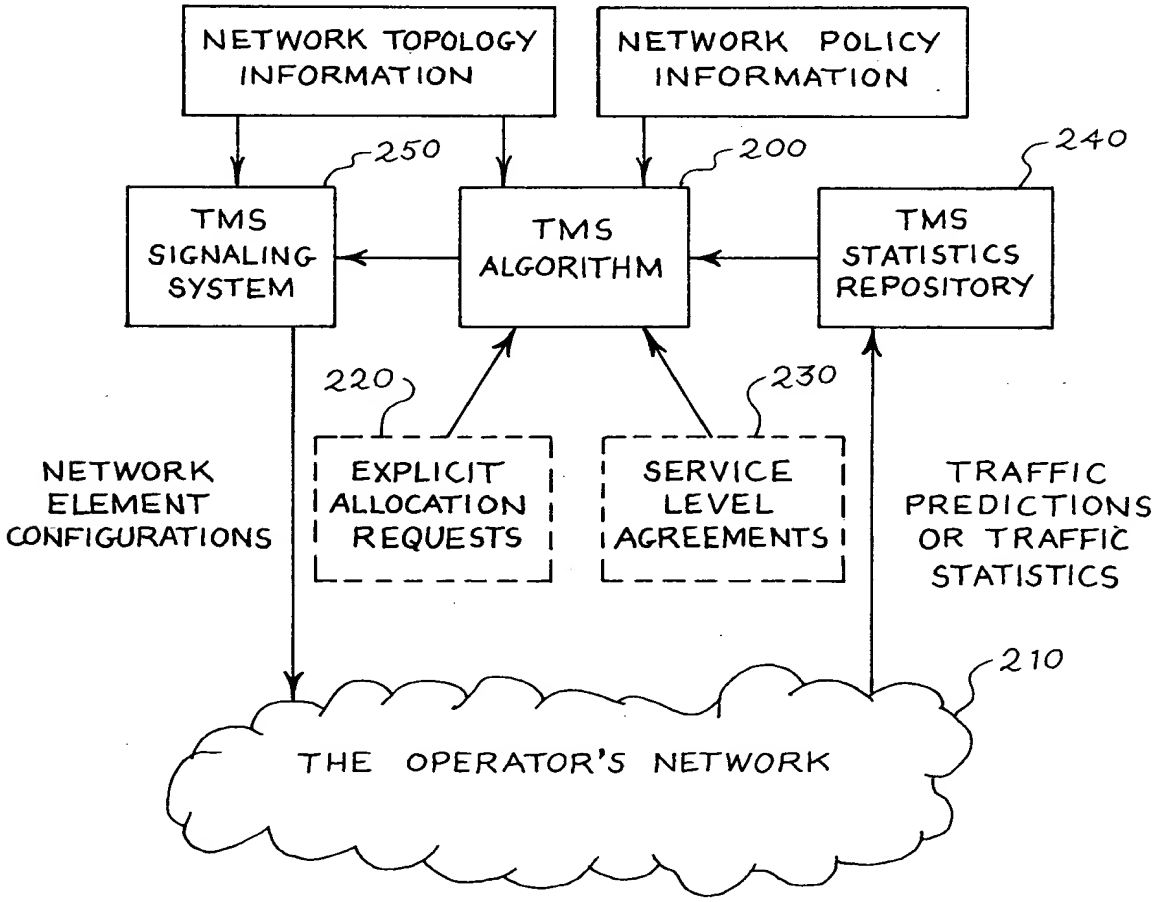
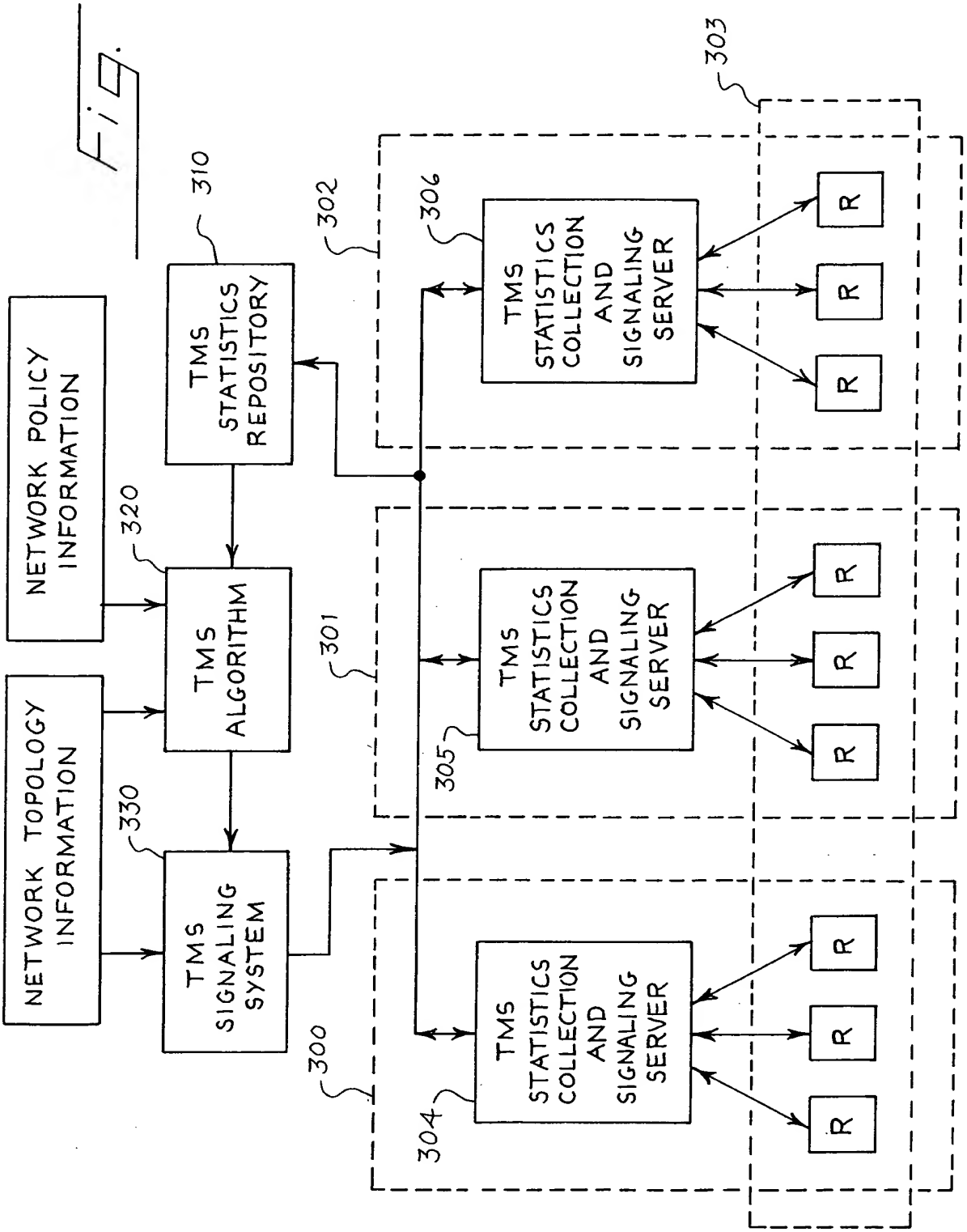

NETWORK TOPOLOGY INFORMATION
NETWORK POLICY INFORMATION
250
200
240
TMS SIGNALING SYSTEM
TMS ALGORITHM
TMS STATISTICS REPOSITORY
220
230
NETWORK ELEMENT CONFIGURATIONS
EXPLICIT ALLOCATION REQUESTS
SERVICE LEVEL AGREEMENTS
TRAFFIC PREDICTIONS OR TRAFFIC STATISTICS
210
THE OPERATOR'S NETWORK

Fig. 3


NETWORK POLICY INFORMATION
NETWORK TOPOLOGY INFORMATION
TMS STATISTICS REPOSITORY
TMS ALGORITHM
TMS SIGNALING SYSTEM
TMS STATISTICS COLLECTION AND SIGNALING SERVER
TMS STATISTICS COLLECTION AND SIGNALING SERVER
TMS STATISTICS COLLECTION AND SIGNALING SERVER
R
R
R
R
R
R
R
R
R
300
301
302
303
304
305
306
310
320
330

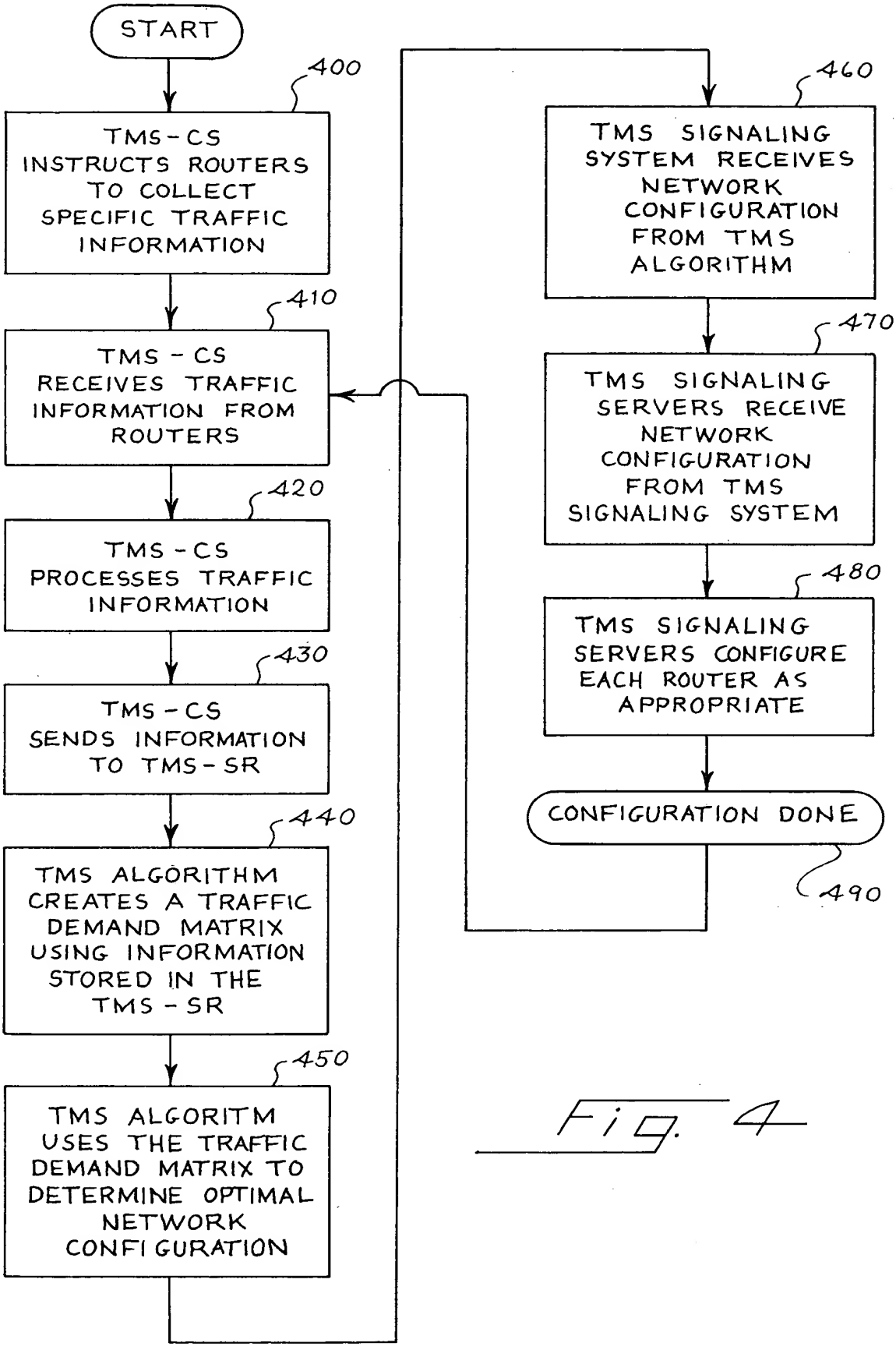

START
400
TMS-CS INSTRUCTS ROUTERS TO COLLECT SPECIFIC TRAFFIC INFORMATION
410
TMS-CS RECEIVES TRAFFIC INFORMATION FROM ROUTERS
420
TMS-CS PROCESSES TRAFFIC INFORMATION
430
TMS-CS SENDS INFORMATION TO TMS-SR
440
TMS ALGORITHM CREATES A TRAFFIC DEMAND MATRIX USING INFORMATION STORED IN THE TMS-SR
450
TMS ALGORITM USES THE TRAFFIC DEMAND MATRIX TO DETERMINE OPTIMAL NETWORK CONFIGURATION
460
TMS SIGNALING SYSTEM RECEIVES NETWORK CONFIGURATION FROM TMS ALGORITHM
470
TMS SIGNALING SERVERS RECEIVE NETWORK CONFIGURATION FROM TMS SIGNALING SYSTEM
480
TMS SIGNALING SERVERS CONFIGURE EACH ROUTER AS APPROPRIATE
CONFIGURATION DONE
490

Fig. 4

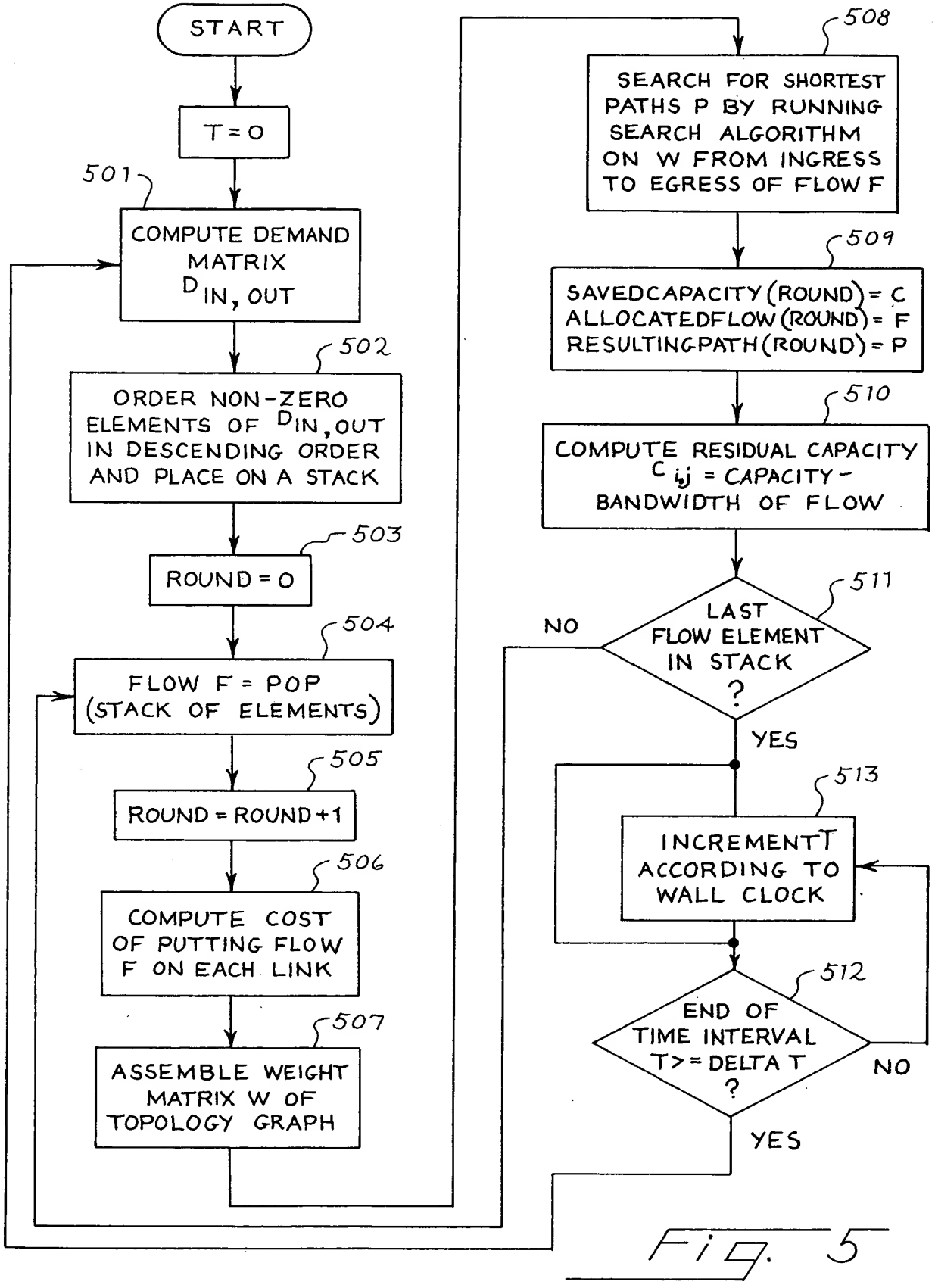

START
T = 0
501
COMPUTE DEMAND MATRIX $D_{IN, OUT}$
502
ORDER NON-ZERO ELEMENTS OF $D_{IN,OUT}$ IN DESCENDING ORDER AND PLACE ON A STACK
503
ROUND = 0
504
FLOW F = POP (STACK OF ELEMENTS)
505
ROUND = ROUND + 1
506
COMPUTE COST OF PUTTING FLOW F ON EACH LINK
507
ASSEMBLE WEIGHT MATRIX W OF TOPOLOGY GRAPH
508
SEARCH FOR SHORTEST PATHS P BY RUNNING SEARCH ALGORITHM ON W FROM INGRESS TO EGRESS OF FLOW F
509
SAVEDCAPACITY(ROUND) = C
ALLOCATEDFLOW(ROUND) = F
RESULTINGPATH(ROUND) = P
510
COMPUTE RESIDUAL CAPACITY $C_{i,j}$ = CAPACITY - BANDWIDTH OF FLOW
511
LAST FLOW ELEMENT IN STACK ?
NO
YES
513
INCREMENT T ACCORDING TO WALL CLOCK
512
END OF TIME INTERVAL T >= DELTA T ?
NO
YES

Fig. 5

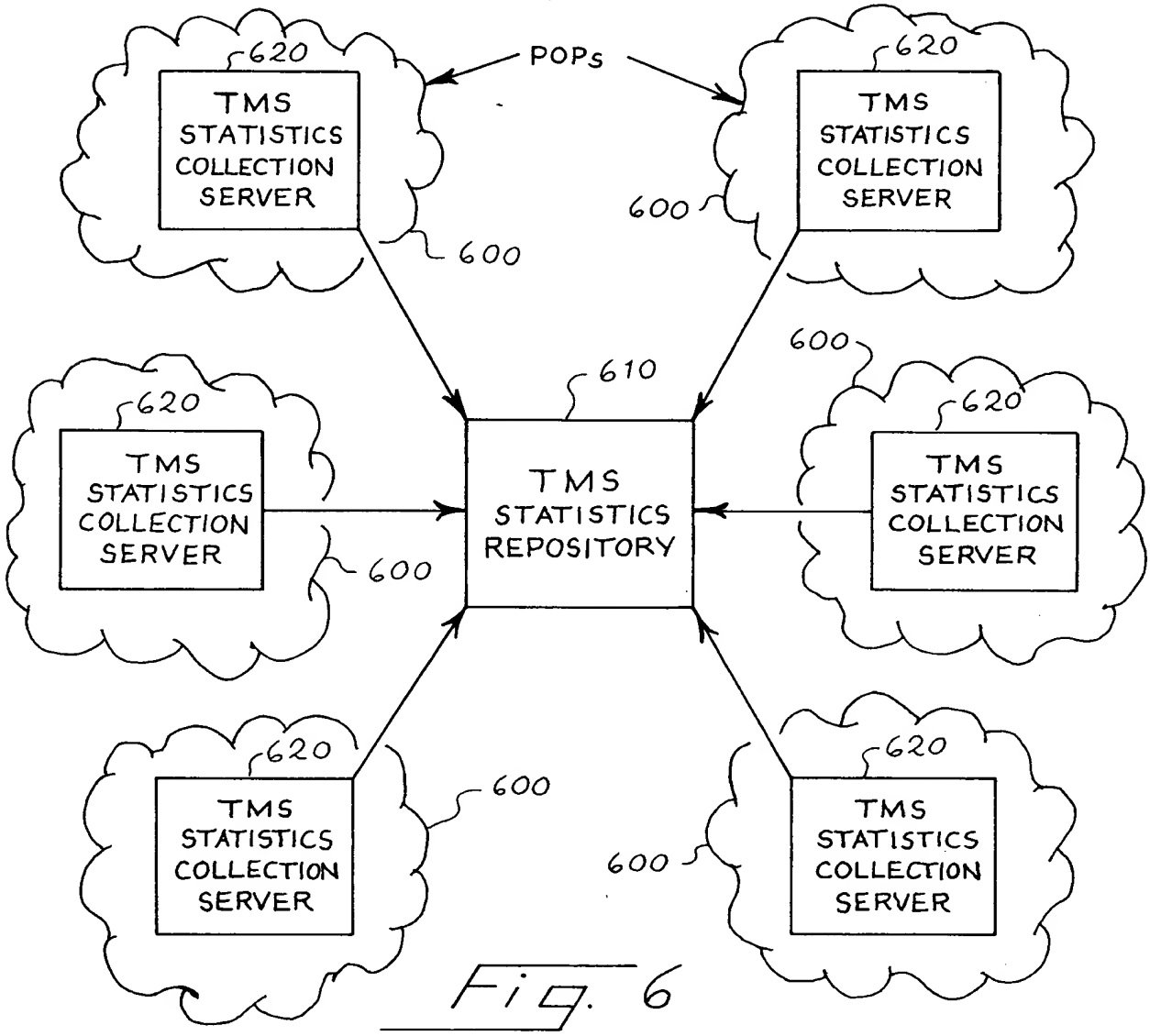
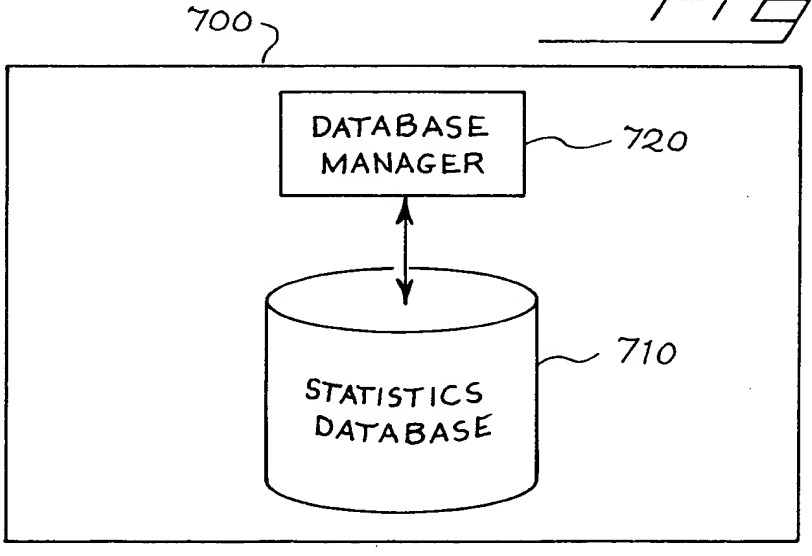


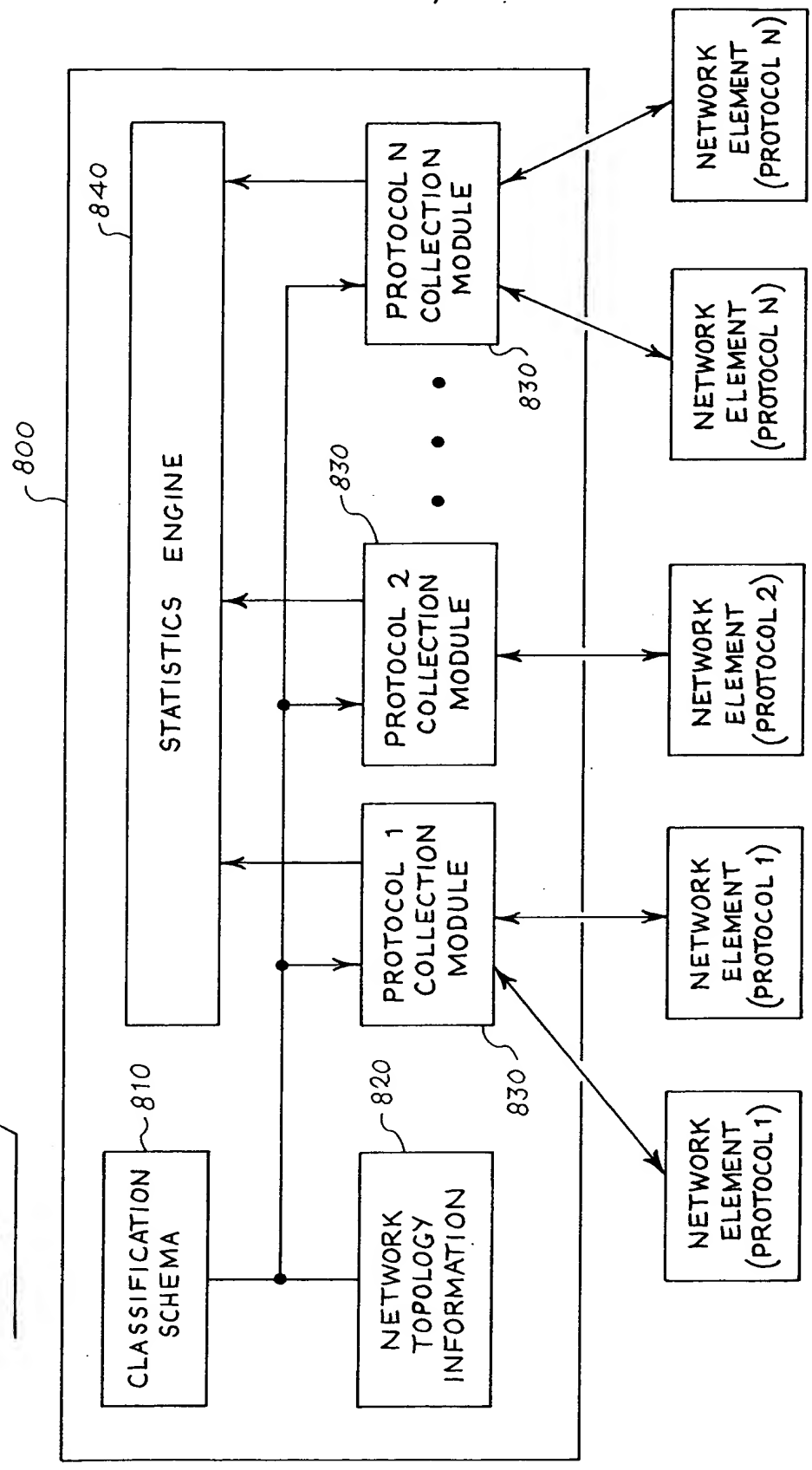
Fig. 6

Fig. 7



TMS STATISTICS REPOSITORY

Fig. 8


800
840
STATISTICS ENGINE
CLASSIFICATION SCHEMA
810
NETWORK TOPOLOGY INFORMATION
820
PROTOCOL 1 COLLECTION MODULE
PROTOCOL 2 COLLECTION MODULE
PROTOCOL N COLLECTION MODULE
830
830
830
NETWORK ELEMENT (PROTOCOL 1)
NETWORK ELEMENT (PROTOCOL 2)
NETWORK ELEMENT (PROTOCOL N)
NETWORK ELEMENT (PROTOCOL N)
TMS STATISTICS COLLECTION SERVER

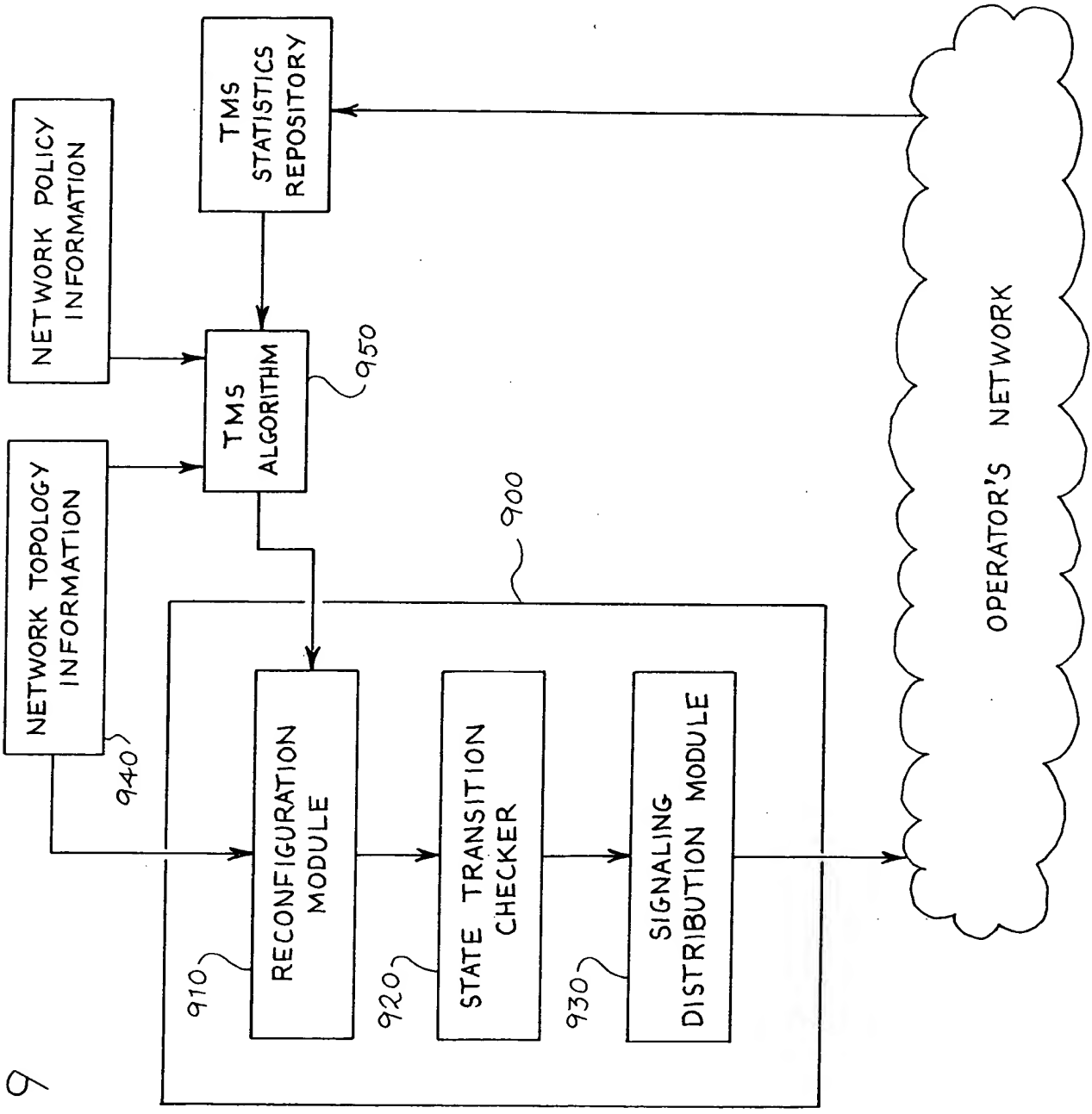

TMS STATISTICS REPOSITORY
NETWORK POLICY INFORMATION
TMS ALGORITHM
950
NETWORK TOPOLOGY INFORMATION
940
900
RECONFIGURATION MODULE
910
STATE TRANSITION CHECKER
920
SIGNALING DISTRIBUTION MODULE
930
OPERATOR'S NETWORK
TMS SIGNALING SYSTEM

Fig. 9

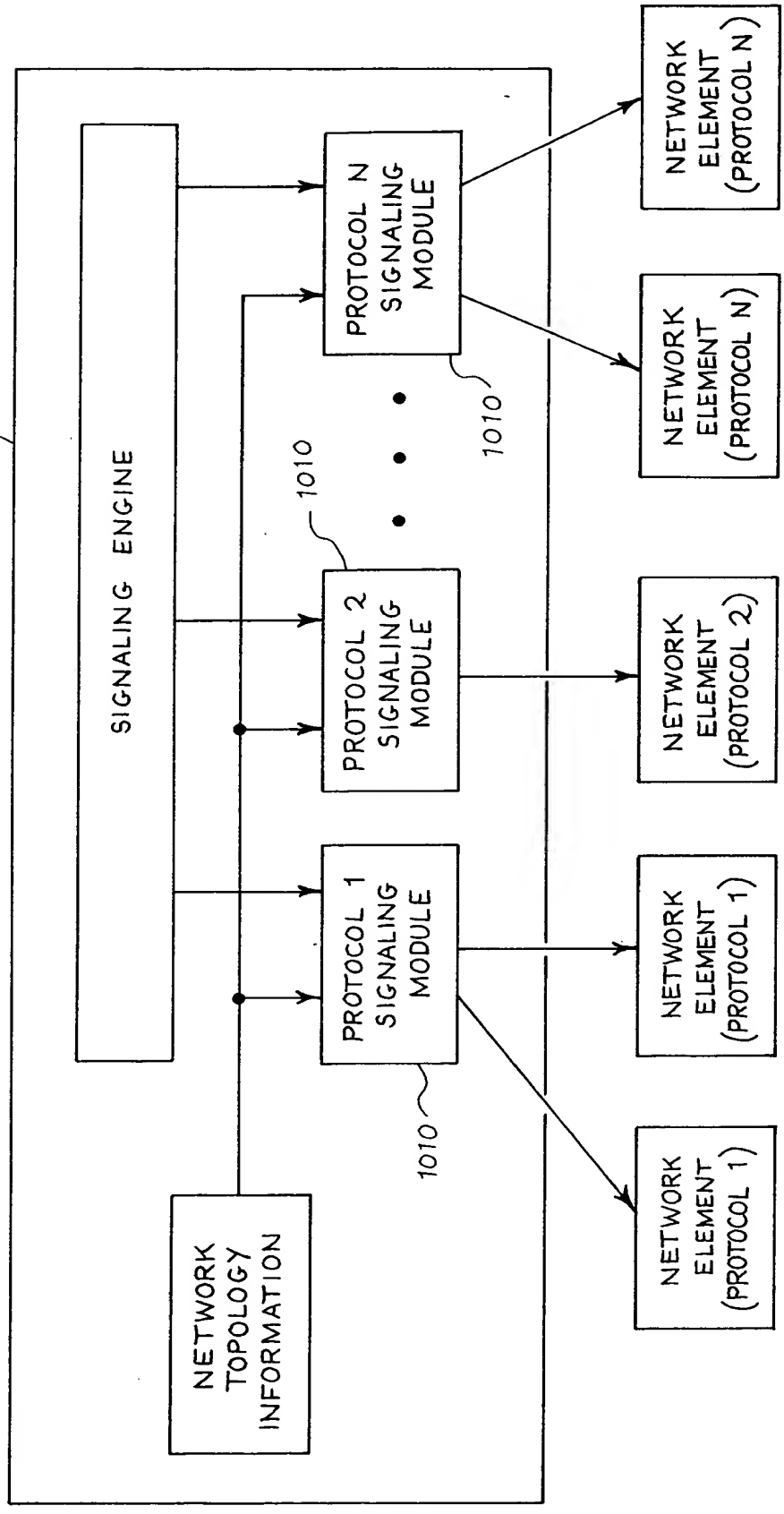

1000
SIGNALING ENGINE
PROTOCOL N SIGNALING MODULE
PROTOCOL 2 SIGNALING MODULE
PROTOCOL 1 SIGNALING MODULE
1010
1010
1010
NETWORK TOPOLOGY INFORMATION
NETWORK ELEMENT (PROTOCOL N)
NETWORK ELEMENT (PROTOCOL N)
NETWORK ELEMENT (PROTOCOL 2)
NETWORK ELEMENT (PROTOCOL 1)
NETWORK ELEMENT (PROTOCOL 1)
TMS SIGNALING SERVER

Fig. 10

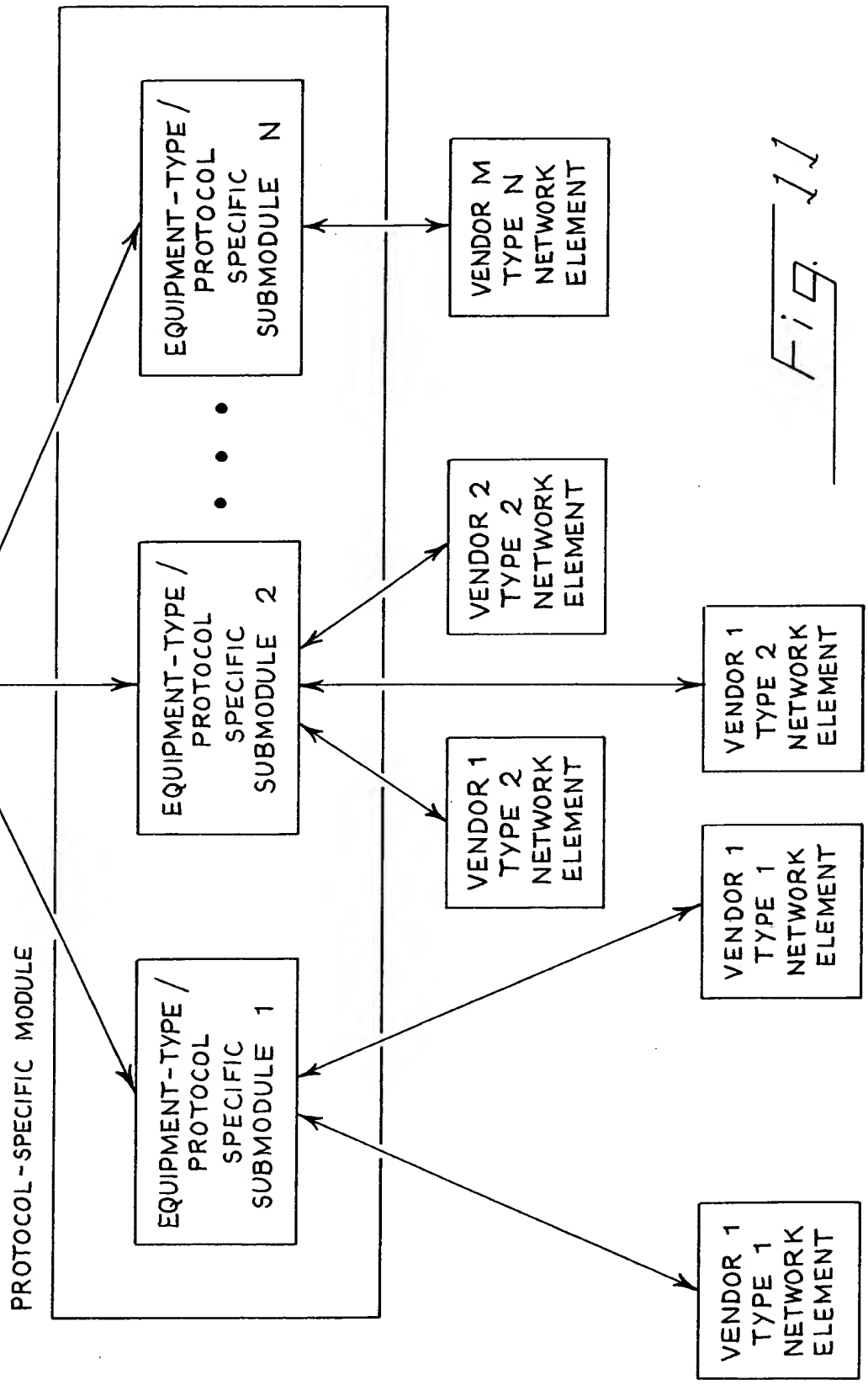

PROTOCOL-SPECIFIC MODULE
EQUIPMENT-TYPE / PROTOCOL SPECIFIC SUBMODULE 1
EQUIPMENT-TYPE / PROTOCOL SPECIFIC SUBMODULE 2
EQUIPMENT-TYPE / PROTOCOL SPECIFIC SUBMODULE N
VENDOR 1 TYPE 1 NETWORK ELEMENT
VENDOR 1 TYPE 2 NETWORK ELEMENT
VENDOR 2 TYPE 2 NETWORK ELEMENT
VENDOR M TYPE N NETWORK ELEMENT
VENDOR 1 TYPE 1 NETWORK ELEMENT
VENDOR 1 TYPE 2 NETWORK ELEMENT

Fig. 11